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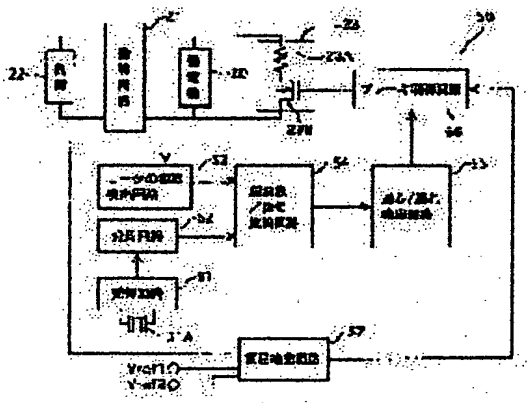
(54) ELECTRONIC CONTROL TYPE MECHANICAL TIMEPIECE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an electronic control type mechanical timepiece which can avoid the stoppage of a system when the torque of a spiral spring declines.
SOLUTION: An electronic control type mechanical timepiece has a rotation control means 50 provided with an oscillation circuit 51 using a crystal resonator, a rotation detecting circuit 53 which detects the rotating speed of a generator 20, a frequency/phase comparator circuit 54 which compares the outputs of the circuits 51 and 53 with each other, a brake control circuit 56 which adjusts the rotating speed of the generator 20 by braking the generator 20, and a voltage detecting circuit 57 which detects the generated output of the generator 20. The brake control circuit 56 controls the power generation of the generator 20 prior to the rotating speed of the generator 20 by relieving or not applying brakes when the generated output of the generator 20 is lower than a set value Vref. Therefore, the voltage drop of the generator 20 can be prevented when the torque of a spiral spring declines and the stoppage of a system can be avoided.



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[JP,11-101879,A]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the electronics control type machine clock which drives correctly the indicator fixed to **** by changing mechanical energy in case a spiral spring opens into electrical energy with a generator, operating a roll control means with the electrical energy, and controlling the rotation period of a generator.

[0002]

[Background of the Invention] What was indicated by JP,8-5758,A is known as an electronics control type machine clock which drives correctly the indicator fixed to **** and displays time of day correctly by controlling the current value which mechanical energy in case a spiral spring opens is changed into electrical energy with a generator, and a roll control means is operated with the electrical energy, and flows in the coil of a generator.

[0003] By such electronics control type machine clock, the indicator by the spiral spring always rotates more quickly than setting speed, and the rotation speed is governed by applying brakes with a roll control means. For this reason, even when performing brake control so that the rotational speed of Rota of a generator may be delayed, the electronics control type machine clock is designed, as the power generated by rotation of Rota operates the control system of a clock and there is remainder further.

[0004] This electronics control type machine clock has an unnecessary motor for a movement drive, in order to make a spiral spring into the source of power for the drive of an indicator, and it has the feature that there are few components mark and it is cheap. The clock was also able to be operated with little input energy that what is necessary is just to generate slight electrical energy required to operate an electronic

circuitry moreover.

[0005]

[Problem(s) to be Solved by the Invention] However, the electronics control type machine clock has the following technical problems. Namely, when a spiral spring comes loose, the spring force of a spiral spring declines and the running torque of Rota is no longer obtained fully, Or if it is made to fall to the speed to which brakes are applied and which synchronizes the rotational frequency of Rota with a time amount standard mostly when voltage has fallen owing to a noise or an impact The voltage which supply of only the power which carries out continuation of the control system of a clock of operation stably depending on the magnitude of the brake becomes impossible, and is supplied may turn into below the minimum operating voltage of a control system.

[0006] Thus, the system stop represented by quenching when the electric energy supplied by rotation of Rota is less than the operating limits of a system, and abnormality actuation were caused, and there was a problem of becoming impossible to brake control normal by that cause.

[0007] The purpose of this invention is to offer the electronics control type machine clock which can avoid a halt of a system, even when the torque of a spiral spring has fallen.

[0008]

[Means for Solving the Problem] A generator from which an electronics control type machine clock of this invention changes into electrical energy mechanical energy of a spiral spring and a spiral spring transmitted through ****, In an electronics control type machine clock equipped with an indicator combined with said ****, and a roll control means to drive with said changed electrical energy and to control a rotation period of said generator An oscillator circuit where a quartz resonator was used for said roll control means, and a rotation detector which detects a rotational frequency of said generator, A comparator circuit which measures an output of said oscillator circuit, and an output of said rotation detector, It has a governing means to adjust rotational speed of said generator based on an output from this comparator circuit, and a generated output detection means to detect generated output of said generator. Said governing means or [loosening control to which rotational speed of a generator is reduced, when generated output of said generator is below the set point] -- or it is characterized by being set up so that it may not carry out.

[0009] An electronics control type machine clock of this invention drives an indicator and a generator by spiral spring, and usually governs a rotational frequency of Rota by applying brakes to a generator. It is loosening, or not applying brakes and, completely carrying out a governing means applying brakes, when torque of a spiral spring falls

like [when a spiral spring has come loose] and power of a generator falls below to the set point on the other hand, that is, is loosening control to which rotational speed of a generator is reduced, or not carrying out at all, and control which reduces rotational speed of a generator positively and governs it is not performed. Since rotational speed of Rota of a generator increases and generated output goes up by this, a halt of a system by lowering of electric power is avoidable.

[0010] As for said governing means, it is desirable to have the progress / delay detector which detects progress and delay of time of day based on an output from said comparator circuit. Progress and delay of this time of day are detectable by detecting progress and delay of a rotational frequency of Rota of a generator etc.

[0011] If a generator is not governed when generated output declines, an indicator may rotate late because an indicator rotates early and an impact etc. joins that time of day progresses **** or a clock, and time of day may be overdue. For this reason, if said progress / delay detector are prepared, a part for a part for progress or delay is counted, by adjusting a brake force applied to Rota of a generator, hand control or when it can wind up automatically and spring force of a spiral spring returns, a spiral spring can carry out governing control so that a part for a part for said progress or delay may be lost, and, thereby, long-term rate stability (precision) in a clock can be secured.

[0012] Moreover, when generated output of a generator goes up after not governing rotational speed of said generator, as for said governing means, it is desirable to be set up so that a part for progress of time of day detected in said progress / delay detector or delay may be canceled and rotational speed of said generator may be governed.

[0013] While not governing by giving priority to a generation of electrical energy, an indicator will shift from exact time of day, but when a part for a part for the gap, a part for i.e., progress, and delay is detected in progress / delay detector, a spiral spring can wind up and generated output goes up, it is governing so that a part for the gap may be canceled, and very much, even if a short time shifts from time of day when an indicator is exact, it can be used as a clock with a precision high in the long run.

[0014] Moreover, said governing means is in a condition of not governing rotational speed of said generator, and when it becomes impossible for a generator to secure a predetermined rotational frequency, it is desirable [a means] to be set up so that a brake force may be applied to a generator and movement of an indicator may be made into a halt or a low speed.

[0015] Also in the condition of not governing without applying brakes to a generator, when it becomes impossible to secure a predetermined rotational frequency, after detecting fixed time amount, it judges that there is no chance that energy supply from a

spiral spring will revive, and a big brake force is applied to a generator. Although a rotational frequency of a generator falls and time of day continuing being overdue over long duration, when the hand is being moved, a user will take for carrying out normal actuation. In order to prevent this, a user can be told about time-of-day delay by applying a big brake force to a generator and carrying out movement to a halt or very low speed movement. Thereby, with time-of-day delay, a user can prevent using a clock, can demand actuation which winds up a spiral spring from a user, and can return an electronics control type machine clock to normal actuation.

[0016]

[Embodiment of the Invention] Below, the operation gestalt of this invention is explained based on a drawing.

[0017] Drawing 1 is the plan showing the important section of the electronics control type machine clock of the 1st operation gestalt of this invention, and drawing 2 and drawing 3 are the cross section.

[0018] The electronics control type machine clock is equipped with the barrel vehicle 1 which consists of spiral spring 1a, barrel gear 1b, barrel truth 1c, and 1d of barrel lids. As for spiral spring 1a, barrel gear 1b and an inner edge are fixed to barrel truth 1c for an outer edge. Barrel truth 1c is supported by a cope plate 2 and ****** 3, and it is being fixed with the angle hole screw 5 so that it may rotate by the angle hole vehicle 4 and one.

[0019] Although the angle hole vehicle 4 is rotated clockwise, ** has geared with ** 6 so that it may not rotate counterclockwise. In addition, since the method of rotating the angle hole vehicle 4 clockwise and rolling spiral spring 1a is the same as that of the automatic volume of a machine clock, or a **** device, explanation is omitted. It accelerates 7 times, accelerates 6.4 times one by one to the No. 2 vehicle 7, and rotation of barrel gear 1b is 9.375 to the No. 3 vehicle 8. To the No. 4 vehicle 9, it accelerates 3 times, and it accelerates 10 times to the No. 5 vehicle 10, and it double-accelerates and a total of 126,000-time accelerating is carried out [it accelerates 10 times and] to Rota 12 to the No. 6 vehicle 11.

[0020] The minute hand 13 is fixed to cylinder kana 7a, and the second hand 14 is being fixed to the No. 4 vehicle 9 for cylinder kana 7a by the No. 2 vehicle 7, respectively. Therefore, what is necessary is just to control Rota 12 to rotate by 5rps, in order to rotate the No. 2 vehicle 7 by 1rph and to rotate the No. 4 vehicle 9 by 1rpm. Barrel gear 1b at this time is set to 1/7rph.

[0021] This electronics control type machine clock is equipped with Rota 12, the stator 15, and the generator 20 that consists of coil blocks 16. Rota 12 consists of Rota magnet

12a, Rota kana 12b, and Rota circle-of-inertia board 12c. Rota circle-of-inertia board 12c is for lessening rotational frequency fluctuation of Rota 12 to the driving torque fluctuation from the barrel vehicle 1. A stator 15 carries out the coil of the stator-coil 15b of 40,000 turns to stator object 15a.

[0022] The coil block 16 carries out the coil of the coil 16b of 110,000 turns to core 16a. Here, stator object 15a and core 16a consist of PC permalloys etc. Moreover, stator-coil 15b and coil 16b are connected to the serial so that the output voltage which applied each generation-of-electrical-energy voltage may come out.

[0023] Next, the control circuit of an electronics control type machine clock is explained with reference to drawing 4 .

[0024] the rectifier circuit 21 where the ac output from a generator 20 consists of pressure-up rectification, full wave rectification, half-wave rectification, transistor rectification, etc. -- letting it pass -- a pressure up -- it is rectified. The loads 22, such as ICs for control, such as a roll control means, and a quartz resonator, are connected to the rectifier circuit 21. In addition, drawing 4 has indicated independently [a load 22] each functional circuit of explanation constituted in IC for convenience.

[0025] The brake circuit 23 from which it connected with the serial and transistor 23B of resistance 23A and Nch, or Pch was constituted by the generator 20 is connected to juxtaposition. The roll control means 50 is connected to the brake circuit 23. In addition, the diode other than damping resistance 23A may be suitably inserted in a brake circuit 23.

[0026] The roll control means 50 is constituted by an oscillator circuit 51, a frequency divider 52, the rotation detector 53, the frequency / phase-comparison circuit 54, the progress / delay detector 55, and the brake control circuit 56.

[0027] An oscillator circuit 51 outputs the oscillation signal by quartz-resonator 51A, and dividing of this oscillation signal is carried out by the frequency divider 52 to a certain fixed period. This dividing signal is outputted to frequency / phase-comparison circuit 54 as a 10Hz criteria periodic signal.

[0028] Frequency / phase-comparison circuit 54 compares the frequency or the phase of the rotation signal of the generator 20 detected in the rotation detector 53, and the criteria periodic signal outputted from the frequency divider 52, searches for the time difference among both, and outputs it to progress / delay detector 55.

[0029] Progress / delay detector 55 consists of updown counters etc., and carries out the sequential count of the output for a part for the progress from frequency / phase-comparison circuit 54, or delay.

[0030] The brake control circuit 56 performs governing control of Rota 12 of a generator

20 according to the output from progress / delay detector 55. That is, the brake control circuit 56 is changing the gate potential of transistor 23B of a brake circuit 23 to high level and a low level, it is intermittent in a brake circuit 23, carries out adjustable [of the amount of current which flows in the coil of a generator 20 by that cause], adjusts the amount of electromagnetic brake, and is governing the generator 20, i.e., the rotation period of an indicator.

[0031] The voltage detector 57 which detects the output voltage of a rectifier circuit 21 as a generated output detection means is connected to the rectifier circuit 21, and the output of the voltage detector 57 is outputted to the brake control circuit 56.

[0032] The control action in such this operation gestalt is explained referring to the graph of drawing 5 .

[0033] First, in drawing 5 , an axis of ordinate expresses the output voltage Vc of a rectifier circuit 21, and a horizontal axis expresses the time amount from the standup of an electronics control type machine clock. If an electronics control type machine clock is operated (time amount t0), a generator 20 will begin to rotate and voltage will rise gradually.

[0034] if voltage rises and the threshold voltage VST which is the minimum operating voltage of a system is exceeded (time amount t1) -- a generator 20 -- getting it blocked -- rotation of an indicator is correctly controlled by the roll control means 50 -- it is usually operated.

[0035] Then, since the running torque which joins Rota is also large, from time amount t1, to t2, voltage Vc rises, consequently a system operates to usual, and exact movement by electronics control is performed at the beginning [of spiral spring 1a] of winding up. Then, the spring of spiral spring 1a comes loose from time amount t2, the spring force of spiral spring 1a declines, and voltage Vc also falls.

[0036] And when it becomes the one or less set point Vref as which sufficient running torque was no longer obtained in Rota 12, and voltage Vc was determined up for a while from the threshold voltage VST (time amount t3), a predetermined signal is outputted to the brake control circuit 56 from the voltage detector 57.

[0037] Although it controls a brake circuit 23 according to the output from progress / delay detector 55, if the brake control circuit 56 has an output from said voltage detector 57, the brake by the brake circuit 23 is loosened at the time of movement (time amount t1-t3), or it controls it not to apply brakes at all, and it usually gives priority to rotation of a generator 20, i.e., ******, over governing control at it. For this reason, the lowered voltage Vc also begins to rise, it does not fall below to the minimum operating voltage VST, and a halt of a system is avoided.

[0038] Then, if spiral spring 1a can wind up and the spring force of spiral spring 1a returns, it will be rash also in rotation of Rota 12 of a generator 20, and voltage Vc will continue rising. If this voltage Vc reaches the bigger set point Vref2 than the set point Vref1 (time amount t4), the roll control means 50 is having applied brakes stronger than predetermined magnitude to Rota 12, and having not applied brakes until now, will delay the advanced time of day and will amend a part for progress. this -- a part for the progress till then (rotational frequency of Rota 12) -- progress / delay detector 55 -- counting -- the part -- it is carried out by delaying rotation, applying brakes strongly. And after time of day is adjusted (time amount t5), rotation of fixed Rota 12 is maintained and the usual movement is performed.

[0039] In addition, in not applying brakes at all, in order that an indicator may usually advance, in progress / delay detector 55, it progresses and a part counts. However, there is variation in the power transmission efficiency of spiral spring 1a, and also in the condition of not applying brakes at all, also when it cannot rotate more than a rotational frequency predetermined in Rota 12, it thinks. Also when only such small rotational energy is supplied, priority is given to normal actuation of a system without completely applying brakes. When a part for the delay of an indicator in the meantime is counted in progress / delay detector 55, spiral spring 1a can wind up and energy supply has revived A brake force smaller than magnitude which is controlled at the time to an original predetermined rotational frequency is applied, or it controls by not applying brakes at all to regain a part for delay.

[0040] Moreover, if spiral spring 1a cannot wind up while giving priority to said generation of electrical energy, said voltage Vc will fall gradually. For this reason, even if it carries out fixed time amount progress in the condition of not applying brakes at all, when it becomes impossible for Rota 12 to secure a predetermined rotational frequency, it judges that the brake control circuit 56 does not have a chance that energy supply will revive, and big damping force is compulsorily apply to a generator 20 by the brake circuit 23, movement is carry out to low-speed movement which is a halt or the degree which a user can recognize clearly, and winding up of spiral spring 1a is demand from a user.

[0041] According to such this operation gestalt, there are the following effects.

[0042] ** Voltage Vref predetermined in the voltage which the voltage detector 57 was established in the roll control means 50, and the torque of spiral spring 1a fell, and was detected in the voltage detector 57 Since priority is given to a generation of electrical energy, without governing by making a brake force smaller than a predetermined value etc. when it falls to below, a halt of the system by generation-of-electrical-energy voltage

falling below to the minimum operating voltage VST of a system is avoidable.
[0043] By this, system stops, such as quenching, and generating of abnormality actuation can be abolished, or it can delay compared with the former, and while being made to the electronics control type machine clock excellent in operational stability of a system, time amount until a clock will stop can be lengthened and a clock can be used continuously for a long period of time.
[0044] ** The result of having not governed since progress / delay detector 55 was formed and priority was given to a generation of electrical energy, When the indicator, i.e., a clock display, shows the time of day when the twist also actually progressed, a part for the progress is counted and grasped in progress / delay detector 55, spiral spring 1a is wound up and the spring force returns Since it is controlling to lose a part for the progress, even when priority is given to a generation of electrical energy in the short term and it does not govern, a gap of time of day can be lost after that, and precision (rate stability) can be made high in the long run.
[0045] Again ** By not only the torque fall of spiral spring 1a but the fall impact, an electromagnetism-noise, etc. A period when the voltage temporarily supplied to a load 22 falls, until the power supply of a system is stabilized, Since a brake can be made small, priority can be given to a generation of electrical energy, and a halt of a system can be prevented, and it can progress after voltage returns, and a part can be amended and a gap of time of day can also be lost, the stable system strong against a noise is realizable.
[0046] ** Progress / delay detector 55 can be regain , not only a part for progress but when energy supply of spiral spring 1a revitalize a part for that delay since a part for delay be also countable when it fall by dispersion in the power transmission efficiency of spiral spring 1a rather than the time of governing with the normal rotational frequency of Rota 12 or , and a system can be operate to stability also at this point , and it can secure a long-term precision .
[0047] ** Since big damping force is compulsorily applied by the brake circuit 23 and movement is carried out to a halt or low-speed movement which a user can recognize clearly in the condition of not applying brakes at all when it becomes impossible for Rota 12 to secure a predetermined rotational frequency, a user can be made to be able to recognize clearly that the clock is not moving the hand normally, and the electronics control type machine clock in the condition of having governed correctly can be used.
[0048] In addition, this invention is not limited to each operation gestalt, and the deformation in the range which can attain the purpose of this invention, amelioration, etc. are included in this invention.

[0049] For example, although the voltage detector 57 is used with said operation gestalt in order to judge power required for operational stability of a system, current may be detected instead of voltage using a supply current value detector.

[0050] Moreover, with said operation gestalt, although progress / delay detector 55 was used, when usually not performing governing control, in order that an indicator may advance rather than always [positive], the circuit which detects only a part for progress may be used with an electronics control type machine clock.

[0051] Furthermore, although he is trying to amend a gap of an indicator while not performing governing control later by forming progress / delay detector 55, you may constitute from said operation gestalt, without forming this progress / delay detector 55. In this case, what is necessary is just to constitute, for example so that a user may be urged to perform winding up and time-of-day doubling of spiral spring 1a again by telling a user by the lamp, the buzzer, vibration, etc. when it is made to give priority to a generation of electrical energy over governing control although a gap of an indicator cannot be amended automatically.

[0052] Moreover, you may make it tell a user by the indicator, the buzzer, vibration, etc. instead of telling a user by a movement halt or low-speed movement, when omitting governing control, without applying brakes, and it becomes impossible for Rota 12 to secure a predetermined rotational frequency.

[0053]

[Effect of the Invention] Since priority is given to a generation of electrical energy, without performing governing control of a generator when according to this invention the torque of a spiral spring falls and the generated output of said generator declines, as stated above, a halt of the system by sag is avoidable.

TECHNICAL FIELD

[A technical field to which invention belongs] This invention relates to an electronics control type machine clock which drives correctly an indicator fixed to **** by changing mechanical energy in case a spiral spring opens into electrical energy with a generator, operating a roll control means with the electrical energy, and controlling a rotation period of a generator.

PRIOR ART

[Background of the Invention] What was indicated by JP,8-5758,A is known as an

electronics control type machine clock which drives correctly the indicator fixed to **** and displays time of day correctly by controlling the current value which mechanical energy in case a spiral spring opens is changed into electrical energy with a generator, and a roll control means is operated with the electrical energy, and flows in the coil of a generator.

[0003] By such electronics control type machine clock, the indicator by the spiral spring always rotates more quickly than setting speed, and the rotation speed is governed by applying brakes with a roll control means. For this reason, even when performing brake control so that the rotational speed of Rota of a generator may be delayed, the electronics control type machine clock is designed, as the power generated by rotation of Rota operates the control system of a clock and there is remainder further.

[0004] This electronics control type machine clock has an unnecessary motor for a movement drive, in order to make a spiral spring into the source of power for the drive of an indicator, and it has the feature that there are few components mark and it is cheap. The clock was also able to be operated with little input energy that what is necessary is just to generate slight electrical energy required to operate an electronic circuitry moreover.

EFFECT OF THE INVENTION

[Effect of the Invention] Since priority is given to a generation of electrical energy, without performing governing control of a generator when according to this invention the torque of a spiral spring falls and the generated output of said generator declines, as stated above, a halt of the system by sag is avoidable.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the electronics control type machine clock has the following technical problems. Namely, when a spiral spring comes loose, the spring force of a spiral spring declines and the running torque of Rota is no longer obtained fully, Or if it is made to fall to the speed to which brakes are applied and which synchronizes the rotational frequency of Rota with a time amount standard mostly when voltage has fallen owing to a noise or an impact The voltage which supply of only the power which carries out continuation of the control system of a clock of operation stably depending on the magnitude of the brake becomes impossible, and is supplied may turn into below the minimum operating voltage of a control system.

[0006] Thus, the system stop represented by quenching when the electric energy supplied by rotation of Rota is less than the operating limits of a system, and abnormality actuation were caused, and there was a problem of becoming impossible to brake control normal by that cause.

[0007] The purpose of this invention is to offer the electronics control type machine clock which can avoid a halt of a system, even when the torque of a spiral spring has fallen.

MEANS

[Means for Solving the Problem] A generator from which an electronics control type machine clock of this invention changes into electrical energy mechanical energy of a spiral spring and a spiral spring transmitted through ****, In an electronics control type machine clock equipped with an indicator combined with said ****, and a roll control means to drive with said changed electrical energy and to control a rotation period of said generator An oscillator circuit where a quartz resonator was used for said roll control means, and a rotation detector which detects a rotational frequency of said generator, A comparator circuit which measures an output of said oscillator circuit, and an output of said rotation detector, It has a governing means to adjust rotational speed of said generator based on an output from this comparator circuit, and a generated output detection means to detect generated output of said generator. Said governing means or [loosening control to which rotational speed of a generator is reduced, when generated output of said generator is below the set point] -- or it is characterized by being set up so that it may not carry out.

[0009] An electronics control type machine clock of this invention drives an indicator and a generator by spiral spring, and usually governs a rotational frequency of Rota by applying brakes to a generator. It is loosening, or not applying brakes and, completely carrying out a governing means applying brakes, when torque of a spiral spring falls like [when a spiral spring has come loose] and power of a generator falls below to the set point on the other hand, that is, is loosening control to which rotational speed of a generator is reduced, or not carrying out at all, and control which reduces rotational speed of a generator positively and governs it is not performed. Since rotational speed of Rota of a generator increases and generated output goes up by this, a halt of a system by lowering of electric power is avoidable.

[0010] As for said governing means, it is desirable to have the progress / delay detector which detects progress and delay of time of day based on an output from said comparator circuit. Progress and delay of this time of day are detectable by detecting

progress and delay of a rotational frequency of Rota of a generator etc.

[0011] If a generator is not governed when generated output declines, an indicator may rotate late because an indicator rotates early and an impact etc. joins that time of day progresses **** or a clock, and time of day may be overdue. For this reason, if said progress / delay detector are prepared, a part for a part for progress or delay is counted, by adjusting a brake force applied to Rota of a generator, hand control or when it can wind up automatically and spring force of a spiral spring returns, a spiral spring can carry out governing control so that a part for a part for said progress or delay may be lost, and, thereby, long-term rate stability (precision) in a clock can be secured.

[0012] Moreover, when generated output of a generator goes up after not governing rotational speed of said generator, as for said governing means, it is desirable to be set up so that a part for progress of time of day detected in said progress / delay detector or delay may be canceled and rotational speed of said generator may be governed.

[0013] While not governing by giving priority to a generation of electrical energy, an indicator will shift from exact time of day, but when a part for a part for the gap, a part for i.e., progress, and delay is detected in progress / delay detector, a spiral spring can wind up and generated output goes up, it is governing so that a part for the gap may be canceled, and very much, even if a short time shifts from time of day when an indicator is exact, it can be used as a clock with a precision high in the long run.

[0014] Moreover, said governing means is in a condition of not governing rotational speed of said generator, and when it becomes impossible for a generator to secure a predetermined rotational frequency, it is desirable [a means] to be set up so that a brake force may be applied to a generator and movement of an indicator may be made into a halt or a low speed.

[0015] Also in the condition of not governing without applying brakes to a generator, when it becomes impossible to secure a predetermined rotational frequency, after detecting fixed time amount, it judges that there is no chance that energy supply from a spiral spring will revive, and a big brake force is applied to a generator. Although a rotational frequency of a generator falls and time of day continuing being overdue over long duration, when the hand is being moved, a user will take for carrying out normal actuation. In order to prevent this, a user can be told about time-of-day delay by applying a big brake force to a generator and carrying out movement to a halt or very low speed movement. Thereby, with time-of-day delay, a user can prevent using a clock, can demand actuation which winds up a spiral spring from a user, and can return an electronics control type machine clock to normal actuation.

[0016]

[Embodiment of the Invention] Below, the operation gestalt of this invention is explained based on a drawing.

[0017] Drawing 1 is the plan showing the important section of the electronics control type machine clock of the 1st operation gestalt of this invention, and drawing 2 and drawing 3 are the cross section.

[0018] The electronics control type machine clock is equipped with the barrel vehicle 1 which consists of spiral spring 1a, barrel gear 1b, barrel truth 1c, and 1d of barrel lids. As for spiral spring 1a, barrel gear 1b and an inner edge are fixed to barrel truth 1c for an outer edge. Barrel truth 1c is supported by a cope plate 2 and ****** 3, and it is being fixed with the angle hole screw 5 so that it may rotate by the angle hole vehicle 4 and one.

[0019] Although the angle hole vehicle 4 is rotated clockwise, ** has geared with ** 6 so that it may not rotate counterclockwise. In addition, since the method of rotating the angle hole vehicle 4 clockwise and rolling spiral spring 1a is the same as that of the automatic volume of a machine clock, or a **** device, explanation is omitted. It accelerates 7 times, accelerates 6.4 times one by one to the No. 2 vehicle 7, and rotation of barrel gear 1b is 9.375 to the No. 3 vehicle 8. To the No. 4 vehicle 9, it accelerates 3 times, and it accelerates 10 times to the No. 5 vehicle 10, and it double-accelerates and a total of 126,000-time accelerating is carried out [it accelerates 10 times and] to Rota 12 to the No. 6 vehicle 11.

[0020] The minute hand 13 is fixed to cylinder kana 7a, and the second hand 14 is being fixed to the No. 4 vehicle 9 for cylinder kana 7a by the No. 2 vehicle 7, respectively. Therefore, what is necessary is just to control Rota 12 to rotate by 5rps, in order to rotate the No. 2 vehicle 7 by 1rph and to rotate the No. 4 vehicle 9 by 1rpm. Barrel gear 1b at this time is set to 1/7rph.

[0021] This electronics control type machine clock is equipped with Rota 12, the stator 15, and the generator 20 that consists of coil blocks 16. Rota 12 consists of Rota magnet 12a, Rota kana 12b, and Rota circle-of-inertia board 12c. Rota circle-of-inertia board 12c is for lessening rotational frequency fluctuation of Rota 12 to the driving torque fluctuation from the barrel vehicle 1. A stator 15 carries out the coil of the stator-coil 15b of 40,000 turns to stator object 15a.

[0022] The coil block 16 carries out the coil of the coil 16b of 110,000 turns to core 16a. Here, stator object 15a and core 16a consist of PC permalloys etc. Moreover, stator-coil 15b and coil 16b are connected to the serial so that the output voltage which applied each generation-of-electrical-energy voltage may come out.

[0023] Next, the control circuit of an electronics control type machine clock is explained

with reference to drawing 4 .

[0024] the rectifier circuit 21 where the ac output from a generator 20 consists of pressure-up rectification, full wave rectification, half-wave rectification, transistor rectification, etc. -- letting it pass -- a pressure up -- it is rectified. The loads 22, such as ICs for control, such as a roll control means, and a quartz resonator, are connected to the rectifier circuit 21. In addition, drawing 4 has indicated independently [a load 22] each functional circuit of explanation constituted in IC for convenience.

[0025] The brake circuit 23 from which it connected with the serial and transistor 23B of resistance 23A and Nch, or Pch was constituted by the generator 20 is connected to juxtaposition. The roll control means 50 is connected to the brake circuit 23. In addition, the diode other than damping resistance 23A may be suitably inserted in a brake circuit 23.

[0026] The roll control means 50 is constituted by an oscillator circuit 51, a frequency divider 52, the rotation detector 53, the frequency / phase-comparison circuit 54, the progress / delay detector 55, and the brake control circuit 56.

[0027] An oscillator circuit 51 outputs the oscillation signal by quartz-resonator 51A, and dividing of this oscillation signal is carried out by the frequency divider 52 to a certain fixed period. This dividing signal is outputted to frequency / phase-comparison circuit 54 as a 10Hz criteria periodic signal.

[0028] Frequency / phase-comparison circuit 54 compares the frequency or the phase of the rotation signal of the generator 20 detected in the rotation detector 53, and the criteria periodic signal outputted from the frequency divider 52, searches for the time difference among both, and outputs it to progress / delay detector 55.

[0029] Progress / delay detector 55 consists of updown counters etc., and carries out the sequential count of the output for a part for the progress from frequency / phase-comparison circuit 54, or delay.

[0030] The brake control circuit 56 performs governing control of Rota 12 of a generator 20 according to the output from progress / delay detector 55. That is, the brake control circuit 56 is changing the gate potential of transistor 23B of a brake circuit 23 to high level and a low level, it is intermittent in a brake circuit 23, carries out adjustable [of the amount of current which flows in the coil of a generator 20 by that cause], adjusts the amount of electromagnetic brake, and is governing the generator 20, i.e., the rotation period of an indicator.

[0031] The voltage detector 57 which detects the output voltage of a rectifier circuit 21 as a generated output detection means is connected to the rectifier circuit 21, and the output of the voltage detector 57 is outputted to the brake control circuit 56.

[0032] The control action in such this operation gestalt is explained referring to the graph of drawing 5 .

[0033] First, in drawing 5 , an axis of ordinate expresses the output voltage Vc of a rectifier circuit 21, and a horizontal axis expresses the time amount from the standup of an electronics control type machine clock. If an electronics control type machine clock is operated (time amount t0), a generator 20 will begin to rotate and voltage will rise gradually.

[0034] if voltage rises and the threshold voltage VST which is the minimum operating voltage of a system is exceeded (time amount t1) -- a generator 20 -- getting it blocked -- rotation of an indicator is correctly controlled by the roll control means 50 -- it is usually operated.

[0035] Then, since the running torque which joins Rota is also large, from time amount t1, to t2, voltage Vc rises, consequently a system operates to usual, and exact movement by electronics control is performed at the beginning [of spiral spring 1a] of winding up. Then, the spring of spiral spring 1a comes loose from time amount t2, the spring force of spiral spring 1a declines, and voltage Vc also falls.

[0036] And when it becomes the one or less set point Vref as which sufficient running torque was no longer obtained in Rota 12, and voltage Vc was determined up for a while from the threshold voltage VST (time amount t<SUB> 3), a predetermined signal is outputted to the brake control circuit 56 from the voltage detector 57.

[0037] Although it controls a brake circuit 23 according to the output from progress / delay detector 55, if the brake control circuit 56 has an output from said voltage detector 57, the brake by the brake circuit 23 is loosened at the time of movement (time amount t1-t3), or it controls it not to apply brakes at all, and it usually gives priority to rotation of a generator 20, i.e., ******, over governing control at it. For this reason, the lowered voltage Vc also begins to rise, it does not fall below to the minimum operating voltage VST, and a halt of a system is avoided.

[0038] Then, if spiral spring 1a can wind up and the spring force of spiral spring 1a returns, it will be rash also in rotation of Rota 12 of a generator 20, and voltage Vc will continue rising. If this voltage Vc reaches the bigger set point Vref2 than the set point Vref1 (time amount t4), the roll control means 50 is having applied brakes stronger than predetermined magnitude to Rota 12, and having not applied brakes until now, will delay the advanced time of day and will amend a part for progress. this -- a part for the progress till then (rotational frequency of Rota 12) -- progress / delay detector 55 -- counting -- the part -- it is carried out by delaying rotation, applying brakes strongly. And after time of day is adjusted (time amount t5), rotation of fixed Rota 12 is

maintained and the usual movement is performed.

[0039] In addition, in not applying brakes at all, in order that an indicator may usually advance, in progress / delay detector 55, it progresses and a part counts. However, there is variation in the power transmission efficiency of spiral spring 1a, and also in the condition of not applying brakes at all, also when it cannot rotate more than a rotational frequency predetermined in Rota 12, it thinks. Also when only such small rotational energy is supplied, priority is given to normal actuation of a system without completely applying brakes. When a part for the delay of an indicator in the meantime is counted in progress / delay detector 55, spiral spring 1a can wind up and energy supply has revived A brake force smaller than magnitude which is controlled at the time to an original predetermined rotational frequency is applied, or it controls by not applying brakes at all to regain a part for delay.

[0040] Moreover, if spiral spring 1a cannot wind up while giving priority to said generation of electrical energy, said voltage Vc will fall gradually. For this reason, even if it carries out fixed time amount progress in the condition of not applying brakes at all, when it becomes impossible for Rota 12 to secure a predetermined rotational frequency, it judges that the brake control circuit 56 does not have a chance that energy supply will revive, and big damping force is compulsorily apply to a generator 20 by the brake circuit 23, movement is carry out to low-speed movement which is a halt or the degree which a user can recognize clearly, and winding up of spiral spring 1a is demand from a user.

[0041] According to such this operation gestalt, there are the following effects.

[0042] ** Voltage Vref predetermined in the voltage which the voltage detector 57 was established in the roll control means 50, and the torque of spiral spring 1a fell, and was detected in the voltage detector 57 Since priority is given to a generation of electrical energy, without governing by making a brake force smaller than a predetermined value etc. when it falls to below, a halt of the system by generation-of-electrical-energy voltage falling below to the minimum operating voltage VST of a system is avoidable.

[0043] By this, system stops, such as quenching, and generating of abnormality actuation can be abolished, or it can delay compared with the former, and while being made to the electronics control type machine clock excellent in operational stability of a system, time amount until a clock will stop can be lengthened and a clock can be used continuously for a long period of time.

[0044] ** The result of having not governed since progress / delay detector 55 was formed and priority was given to a generation of electrical energy, When the indicator, i.e., a clock display, shows the time of day when the twist also actually progressed, a

part for the progress is counted and grasped in progress / delay detector 55, spiral spring 1a is wound up and the spring force returns Since it is controlling to lose a part for the progress, even when priority is given to a generation of electrical energy in the short term and it does not govern, a gap of time of day can be lost after that, and precision (rate stability) can be made high in the long run.

[0045] Again ** By not only the torque fall of spiral spring 1a but the fall impact, an electromagnetism noise, etc. A period when the voltage temporarily supplied to a load 22 falls, until the power supply of a system is stabilized, Since a brake can be made small, priority can be given to a generation of electrical energy, and a halt of a system can be prevented, and it can progress after voltage returns, and a part can be amended and a gap of time of day can also be lost, the stable system strong against a noise is realizable.

[0046] ** Progress / delay detector 55 can be regain , not only a part for progress but when energy supply of spiral spring 1a revitalize a part for that delay since a part for delay be also countable when it fall by dispersion in the power transmission efficiency of spiral spring 1a rather than the time of governing with the normal rotational frequency of Rota 12 or , and a system can be operate to stability also at this point , and it can secure a long-term precision .

[0047] ** Since big damping force is compulsorily applied by the brake circuit 23 and movement is carried out to a halt or low-speed movement which a user can recognize clearly in the condition of not applying brakes at all when it becomes impossible for Rota 12 to secure a predetermined rotational frequency, a user can be made to be able to recognize clearly that the clock is not moving the hand normally, and the electronics control type machine clock in the condition of having governed correctly can be used.

[0048] In addition, this invention is not limited to each operation gestalt, and the deformation in the range which can attain the purpose of this invention, amelioration, etc. are included in this invention.

[0049] For example, although the voltage detector 57 is used with said operation gestalt in order to judge power required for operational stability of a system, current may be detected instead of voltage using a supply current value detector.

[0050] Moreover, with said operation gestalt, although progress / delay detector 55 was used, when usually not performing governing control, in order that an indicator may advance rather than always [positive], the circuit which detects only a part for progress may be used with an electronics control type machine clock.

[0051] Furthermore, although he is trying to amend a gap of an indicator while not performing governing control later by forming progress / delay detector 55, you may

constitute from said operation gestalt, without forming this progress / delay detector 55. In this case, what is necessary is just to constitute, for example so that a user may be urged to perform winding up and time-of-day doubling of spiral spring 1a again by telling a user by the lamp, the buzzer, vibration, etc. when it is made to give priority to a generation of electrical energy over governing control although a gap of an indicator cannot be amended automatically.

[0052] Moreover, you may make it tell a user by the indicator, the buzzer, vibration, etc. instead of telling a user by a movement halt or low-speed movement, when omitting governing control, without applying brakes, and it becomes impossible for Rota 12 to secure a predetermined rotational frequency.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the plan showing the important section of the electronics control type machine clock in 1 operation gestalt of this invention.

[Drawing 2] It is the cross section showing the important section of drawing 1.

[Drawing 3] It is the cross section showing the important section of drawing 1.

[Drawing 4] It is drawing showing the circuit of the important section of said operation gestalt.

[Drawing 5] It is a graph about the voltage and time amount explaining actuation of the governing means of said operation gestalt.

[Description of Notations]

1 Barrel Vehicle
1a Spiral spring
7 No. 2 Vehicle
8 No. 3 Vehicle
9 No. 4 Vehicle
10 No. 5 Vehicle
11 No. 6 Vehicle
12 Rota
13 Minute Hand
14 Second Hand
15 Stator
16 Coil Block
20 Generator

21 Rectifier Circuit
22 Load
23A Resistance
23B Transistor
23 Brake Circuit
50 Roll Control Means
51A Quartz resonator
51 Oscillator Circuit
52 Frequency Divider
53 Rotation Detector
54 Frequency / Phase-Comparison Circuit
55 Progress / Delay Detector
56 Brake Control Circuit
57 Voltage Detector

[Translation done.]